PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04J 3/16, H04H 1/00 — A1

(11) International Publication Number: **WO 97/48200**

(43) International Publication Date: 18 December 1997 (18.12.97)

(21) International Application Number: PCT/FI97/00355

(22) International Filing Date: 9 June 1997 (09.06.97)

(30) Priority Data:

U960344	7 June 1996 (07.06.96)	FI
963523	9 September 1996 (09.09.96)	FI
963606	13 September 1996 (13.09.96)	FI

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

(71) Applicant *(for all designated States except US)*: TELECOM FINLAND OY [FI/FI]; P.O. Box 106, FIN-00051 Tele (FI).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: MATTILA, Pekka [FI/FI]; Tikantie 7, FIN-04320 Tuusula (FI). LEISIO, Sulo [FI/FI]; Itälahdenkatu 5 A 16, FIN-00210 Helsinki (FI).

(74) Agent: LAHTI, Heikki; Telecom Finland Oy, P.O. Box 106, FIN-00051 Tele (FI).

Published

With international search report.

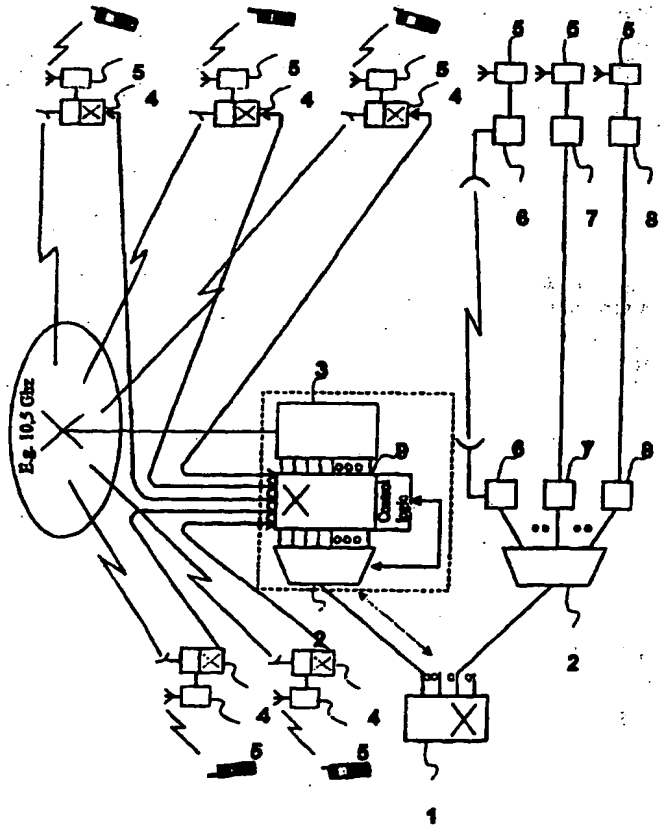
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

In English translation (filed in Finnish).

(54) Title: DYNAMIC ALLOCATION FOR POINT TO MULTIPOINT TELECOMMUNICATION SYSTEM

(57) Abstract

The invention relates to a Point to multipoint or PMP-telecommunications system, which is formed of a central station (3), and a required amount of substations (4). Characteristic for the invention is that in the system each substation has a multiplexed predetermined capacity access interface of a telecommunication service, and transmission capacities to various substations are allocable by cross-connecting, and that in a transmission way of PMP-system capacity is allocated by utility signals, which are transmitted between the central station and base stations. The transmission way of the PMP-system is a radio way, optical fibre or copper cable. For managing transmission capacity, a central station of PMP-system includes a cross-connection part and a control logic part, and besides each substation has a cross-connection part equipped with a control logic. In the system, a respective occupancy situation of the substations is reacted dynamically by cross-connecting capacity directed by the control logic of the system in accordance with their traffic and/or resource needs, preferably a direction of capacity occurs either on the basis of incoming traffic, outgoing traffic or as commanded by a predetermined capacity requirement. Finding of a right utility signal of the substation from a time division transmission way and transmission of the return signal is directed by synchronisation information between central and substations.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

DYNAMIC ALLOCATION FOR POINT TO MULTIPOINT TELECOMMUNICATION SYSTEM

The invention relates to the control of data transmission. More accurately the object of the present invention is a telecommunication method for point to multipoint or PMP-telecommunications system according to the preamble of the claim 1 both point to multipoint or PMP-telecommunications system according to the preamble of the claim 8. In this case PMP-telecommunications system, which is formed of a central station and a required amount of substations. The invention can be applied to data transmission between base station controllers and base stations, and in different telecommunications networks, industrial automation networks, different investigations, TV- and radio program transfer, video conferences, control, guard, energy and water maintenance and also in transmission of signals by radio or cable ways from a node of a network to an operation point used in real estate automation networks.

In the systems according to the prior art PMP (Point-to-MultiPoint) -applications have offered fixed or operation request activated connections between a separate interface gate or multiplexed time interval and a customer interface gate of the PMP-substation over the radio way. In this case the connection in question when valid requests on the radio way at least the same net bit speed as in the customer interface of the PMP-substation. If the customer interface is e.g. 2 Mbit/s and a temporary or a permanent operation requirement of the customer is only few 64 kbit/s time division channel, PMP-system allocates always a capacity of 2 Mbit/s from the radio way. Then the operation of the radio channel is inefficient.

The objective of the present invention is to achieve a new and a universal solution to rapidly changing and to different transmission speeds capacity requirements in difficult data transfer conditions. Particularly the objective of the present invention is to achieve flexible capacity transmission connections by rapid timetable, in the data transmission

of targets otherwise difficultly and costly attainable by the present technique, manually or dynamically allocated.

This objective is achieved by the telecommunications method like mentioned in the beginning, to which characterised features are presented in the characterising parts of the enclosed claims 1-7, and by the telecommunications system, to which characterised features are presented in the characterising parts of the enclosed claims 8-14.

The bi-directional PMP-telecommunications system according to the present invention is formed of a central station and a required amount of substations. The customer interface multiplexed in the system on the PMP-substations operates continuously at desired bit speed, e.g. 2 Mbit/s, but only a transmission capacity corresponding the operation is allocated from the transmission way, e.g. only 4 x 64 kbit/s. By the cross-connection and the network control system according to the invention from the multiplexed interfaces inter central station and telecommunications network can any time interval be directed to any PMP-substations any time interval of the multiplexed interface either manually and permanently or directed automatically by any occupancy algorithm or generated by a temporary communication requirement.

In the system according to the present invention on each substation of the PMP-system has a predetermined capacity multiplexed access interface of a telecommunication service. Noteworthy in the invention is, that the transmittable signals, for instance time intervals, are freely dynamically allocable by cross-connecting. For managing the transmission capacity the central station of the PMP-system includes a cross-connection part and a control logic part, and besides each substation of the PMP-system has a cross-connection part provided with control logic. This makes possible the transmission of various data transmission services, for instance existing and future wired and wireless different frequency band telecommunication services through the same PMP-system. Between the central station and the substations only the utility signals e.g. n x 64 kBit/s instead the present 2 Mbit/s, n x 2 Mbit/s or separate 64 kBit/s (300...3400Hz) are transmitted in the system. The utility signals mean transmittable

data and time intervals containing network management information. Only these transmittable utility signals strain the transmission way of the PMP-system. Hereby savings are achieved, which the systems utilised nowadays cannot generate for this inflexibility. The transmission way of the PMP-system can be a radio way, optical fibre or copper cable.

The telecommunications system according to the invention is a new dynamic transmission network concept developed from Point-to-MultiPoint radio transmission system. The signals meant to be transferable on the central station, for instance from the mobile telephone network's base station controller (BSC) or 2 Mbit/s connections brought from exchanges and 64 kbit/s time intervals located inside them are collected and multiplexed by a cross-connection device inside the transferable frame. The frame can be e.g. 2 Mbit/s, 8 Mbit/s, 34 Mbit/s, n x 2 Mbit/s or some other frame in accordance with the predominant standard, in which e.g. 64 kbit/s time intervals are cross-connected by saving capacity time divisionally sequentially to bring further to the transmitter/receiver unit. From the transmitter the signal is directed to the transmission way to bring further to the substation's receivers. On the substation the utility signal is collected from the time division transmission way meant to the substation in question from the time division band transmitted by the transmitter. To the respective occupancy situation of the substations can be reacted dynamically by allocating utility capacity directed by the control logic of the system where it is respectively needed. The finding of the right utility signal of the substation is directed by synchronising information between central and substations. The need for increase the transmission capacity to the system is attained either on the basis of incoming or outgoing traffic or on the basis of a predetermined traffic profile information. The traffic profile information represents the intensity of the traffic as time function on a particular time interval, for instance on a 24-hour period.

The advantages of the invention is to achieve flexible capacities transmission interfaces by rapid timetable, in the data transmission of the targets otherwise difficultly and costly attainable by the present technique, manually or dynamically allocated. Here the

rapidity means that, the equipment is formed of the central station and a great amount of customer / application-wide substation installed in connection with an introduction of a new connection. In connection with the introduction of the new connection there's no need to make modifications physically. It's sufficient with the addition of substations to the network when arising a new traffic requirement.

The system is particularly frequency efficient as compared with present. In other words the capacity can be utilised better as compared with the existing systems, because the loss capacity is vanishing small.

On the radio transmission way as the radio frequency of the system is used e.g. frequency areas 10,5 Ghz or higher in the cities and on the countryside when long connections in question frequency area of <3 Ghz. The frequency control authorities define the utilised frequency bands application-widely separately. (Long and short way versions).

The invention will be described more particularly in the following with reference to the accompanying drawings, in which

figure 1 represents the principle of the dynamical PMP-system in a mobile communications network

figure 2 represents an example of the location of the time intervals used by the different substations in the transmission frame of the PMP-system

figure 3 represents an example of the management of the multiplexed interfaces of the substations in the PMP-system

In the figure 1 it has been represented as an example the principle of the dynamic PMP-system (point to multipoint connection) according to the invention in the mobile communications network. The mobile communication network includes mobile services switching centre 1, base station controller 2 and number of base stations 5. The base station controller is the mobile communication network's part, which controls the

operation of base stations. Data transmission (speech and signal information) between the base station controller and the base station is managed in the systems according to the prior art either by a radio link 6 between two points, optical cable connection 7 or copper cable connection 8. In the system according to the invention the data transmission between the base station controller and the base stations is dealt with the PMP-system. The PMP-system includes a central station 3, to which has been added a control logic part required by the system, and a number of substations 4. Each substation of the PMP-system has a predetermined capacity multiplexed customer interface to a base station. The incoming signals are carried from the base station controller to the PMP-system through the cross-connection device 9, to which it has been attached the control logic part for managing the transmission capacity. If wanted the base station controller, the cross-connection device and the substation of the PMP-system can be integrated to one device entity. The signals meant to be transferable on the central station, e.g. 2 Mbit/s connections brought from the mobile telephone network's base station controller and 64 kbit/s time intervals located inside them are collected and multiplexed by cross-connection device into the transferable frame. The frame can be e.g. 2 Mbit/s frame, in which 64 kbit/s time intervals are cross-connected by saving capacity time divisionally sequentially to bring further to the transmitter/receiver unit. From the transmitter the signal is directed to the round radiant or sectored aerial to carry further to the receiver of the substation, which includes also the cross-connection part equipped with the control logic part.

On the substation from the time division transmission way it is collected the utility signal meant to the substation in question from the time division band transmitted by the transmitter. To the respective occupancy situation of the substations are reacted dynamically by increasing utility capacity by means according to the control logic of the system where it is respectively needed. The finding of the right utility signal of opposite station from time division transmission way is directed by synchronising information between transmission and substations. The need for increase the transmission capacity is attained either on the basis of incoming calls from mobile stations, on

the basis of incoming calls from a mobile services switching centre or on the basis of a predetermined traffic profile information.

In the figure 2 it has been presented an example of a location of time intervals utilised by different substations in the transmission frame of the PMP-system. In the figure it has been assumed that both mobile communication system's and PMP-system's transmission frame is composed of 32 time intervals. In the figure from the base station controller 21 there is one 32 time interval connection to the cross-connection device 22 per respective base stations 23. In the PMP-system it is transmitted over the radio way to the respective base station only the time intervals in use aligned for it located in the PMP-system's transmission frame. When the capacity allocation is dynamic, the base station obtains locally more time intervals for utilisation as long as there are free time intervals to allocate when the mobile station traffic is increasing. So even one base station can obtain for utilisation in case of need even the whole transmission capacity of the PMP-system when the traffic being subtle on the other base stations.

In the figure 3 it has been presented an example of management of the multiplexed interfaces of the substations in the PMP-system. The PMP- central station transmits to receivers of the sub or repeating stations locating on the coverage area of its antenna for instance frame construction according to the figure 3, where there are the following bit groups (time intervals):

S : a synchronisation part of a frame

n : to a substation locally set number, by which a station in question identifies a network management messages allocated to it

m : a number (identifier) of a local location of a customer interface (group) of a substation n

k : a number of a multiplexed time interval of a customer interface m

b : a bit speed of a time interval k (if adjustable)

fo : other control information related to time interval k, such locations of time intervals in a frame construction from the central station to the

substations and from the substations to the central station, et cetera fo's information to develop PMP-system's own automatism.

Besides in the network management time intervals can be transmitted other necessary control information both error supervision and error correction codes. The occurrence of the information in the PMP- frame construction depends on the connection modes of the proper system. In the rapid control of the substations can be given control information concerning different targets in the sequential basic frames. If a connection mode of a substation detects network management time periods requiring repeat broadcast, it informs about them in own management frames to the central station, which transmits the required information again in the subsequent basic frames to the substation in question.

By the network management system connected to the central station it is arranged respectively needed information to the frame's network management time intervals. For the viewpoint of the invention the essential settings n, m, k, b can be given manually from a network management device (the continuous utilisation of PMP- time intervals) or the settings are taken automatically from the system keeping track of the occupancy situation (the dynamic control of PMP- time intervals).

The PMP- central station connects a fixed telenetwork by multiplexing groups. When wanted to connect time interval i of a multiplexing-group R to the sub station n to the multiplexing group m to the time interval k at the bit speed of b the information in question is set to the PMP- network management system and to transmit it by the frame construction as presented to a substation in question, which own local network management unit performs required connections.

An actual customer traffic from central station to substations is transmitted in traffic intervals L1...Lx.

Previously it has been presented as an example a solution applied to a mobile communications network. The invention can be applied also in transmission of signals utilised in other telecommunications networks, industrial automation networks, different investigations, TV- and radio program transfer, video conferences, control, guard, energy and water maintenance both real estate automation networks from a node of a network to an operation point. The system can be utilised by any data transmission speed and transferable information can be any type (e.g. speech, image, data, alarms et cetera).

Application objects of the invention in a telecommunications networks are transmission connections of mobile- and company networks which are difficultly, slowly and expensively feasible by traditional means and a flexible capacity Wireless Access - solution. As a special solution the system can be utilised also as a part in sparsely populated area's telecommunications networks between centralizers and upper centres subsistent its top. The system can be utilised also as a transmission system of a new kind of broadband radiosystems.

As a satellite application the system can be used as a comprehensive data transmission solution of any sparsely populated or difficultly any other way attainable areas, in case a required capacity keeps in tolerable boundaries.

As a modification alternative of the invention the system can be made, where a predetermined fixed part of PMP-system's capacity is utilised in one operation point (for instance mobile filming equipment, compressed MPEG-image, or a map application of a vehicle, mobile rapid data). Then by using a control logic of the system a predetermined fixed part of capacity of the system can be directed to employment of a substation located next to the operation point when the operation point is moving by keeping track of signal intensities, when the mobile application obtains unbroken constant capacity data transmission connection when moving in the areas of different substations.

Previously the PMP-system's dynamic capacity allocation on the radio way has been described in a time division TDMA (Time Division Multiple Access) -radio transmis-

sion system. As well it can be implemented in FDMA (Frequency Division Multiple Access) or CDMA (Code Division Multiple Access) -radio transmission system.

Modifications of the system can be presented so, that at the first stage the system could be in accordance with described, but the allocation could be manually substation by case to do before the dynamic is obtained to be developed to the system.

A modification of the invention relates to utilisation of the cross-connection device to direct in the mobile communications network the optimisation of channel amount of different base stations of a base station network. In a cellular network formed of base stations same frequencies repeat in base stations in big cities between 2-5 km and even on rural area between 15 - 50 km, which is smaller than a distance, from which the base stations disturb each others. When the same frequencies repeat consequently the base stations utilise separate time intervals. Now two base stations are chosen, which have different traffic profiles. In accordance with these predetermined capacity requirements channels are transferred by using the control logic of the cross-connection device or time intervals in a predetermined moments from a base station to another, when more effective utilisation of radio network's frequency capacity is achieved than in the systems in accordance with the prior art, in which the channel amount of every base station is constant.

Previously the invention has been described by referring to its preferable embodiment example. However by this it's not wanted to restrict the invention to concern only this example but all modifications are possible within the inventive idea described by the following claims.

CLAIMS

1. A telecommunications method for point to multipoint or PMP-telelecommunications system, which PMP-telecommunications system is formed of a central station (3), and a required amount of substations (4), **characterised** in that in the method to each substation of the PMP-telecommunications system has been multiplexed a predetermined capacity access interface of a telecommunication service, and transmission capacities to substations are allocable by cross-connecting, and that in a transmission way of PMP-telecommunications system capacity is allocated by utility signals, which are transmitted between the central station and base stations.

2. A telecommunications method according to the claim 1, **characterised** in that a transmission way is chosen from a group radio way, optical fibre and copper cable and/or combination of them.

3. A telecommunications method according to the claim 1, **characterised** in that for managing data transmission capacity the central station of PMP-system includes a cross-connection part and a control logic part, and besides to each substation is adjusted a cross-connection part equipped with control logic.

4. A telecommunications method according to the claims 1-3, **characterised** in that to a respective occupancy situation of substations is reacted dynamically by cross-connecting capacity directed by the control logic of the system to the substations in accordance with their resource needs, preferably the capacity direction occurs either on the basis of incoming or outgoing traffic or commanded by a predetermined capacity requirement.

5. A telecommunications method according to the claims 1-4, **characterised** in that the allocation is implemented by a radio transmission system, which is TDMA-, FDMA or CDMA-system, and that on a substation it is collected a utility signal meant to the substation in question from a time-, frequency- or code division band and in a return

direction a transmitter of the substation transmits only those time intervals or frequencies, to which it has the transmittable utility signal.

6. A telecommunications method according to the claims 1-5, **characterised** in that a finding of the right utility signal of the substation from the time division transmission way and the transmission of the return signal is directed by synchronisation information between central- and substations.

7. A telecommunications method according to the claims 1-6, **characterised** in that a predetermined fixed part of data transmission capacity of central station is utilised in one operation point, when the predetermined fixed part of capacity is directed by using control logic when operation point is moving by keeping track of signal strengths to utilisation of a substation located next to the operation point, when the moving application obtains unbroken constant capacity telecommunication connection when moving in areas of various substations.

8. A point to multipoint or PMP-telecommunications system, which is formed of a central station (3), and a required amount of substations (4), **characterised** in that in the system on each substation has multiplexed a predetermined capacity access interface of a telecommunication service, and transmission capacities to different substations are allocable by cross-connecting, and that in a transmission way of PMP-telecommunications system capacity is allocated by utility signals, which are transmitted between the central station and base stations.

9. A system according to the claim 8, **characterised** in that the transmission way of the PMP-system is chosen from a group radio way, optical fibre and copper cable and/or combination of them.

10. A system according to the claim 8, **characterised** in that for managing data transmission capacity the central station of PMP-system includes a cross-connection part

and a control logic part, and besides each substation has a cross-connection part equipped with control logic.

11. A system according to the claims 8 - 10, **characterised** in that in the system to a respective occupancy situation of the substations is reacted dynamically by cross-connecting capacity directed by the control logic of the system in accordance with their resource needs, preferably the capacity direction occurs either on the basis of incoming traffic, outgoing traffic or commanded by a predetermined capacity requirements.

12. A system according to the claims 8 - 11, **characterised** in that the allocation is implemented by radio transmission system, which is TDMA-, FDMA or CDMA-system, and that on a substation it is collected a utility signal meant to the substation in question from time-, frequency- or code division band and in a return direction a transmitter of the substation transmits only those time intervals or frequencies, to which it has the transmittable utility signal.

13. A system according to the claims 8 - 12, **characterised** in that a finding of the right utility signal of the substation from the time division transmission way and the transmission of the return signal is directed by synchronisation information inter central- and substations.

14. A system according to the claims 8 - 13, **characterised** in that a predetermined fixed part of data transmission capacity of central station is utilised in one operation point, when the predetermined fixed part of capacity is directed by using control logic when operation point is moving by keeping track of signal strengths to utilisation of a substation located next to operation point, when the moving application obtains an unbroken constant capacity telecommunication connection when moving in areas of various substations.

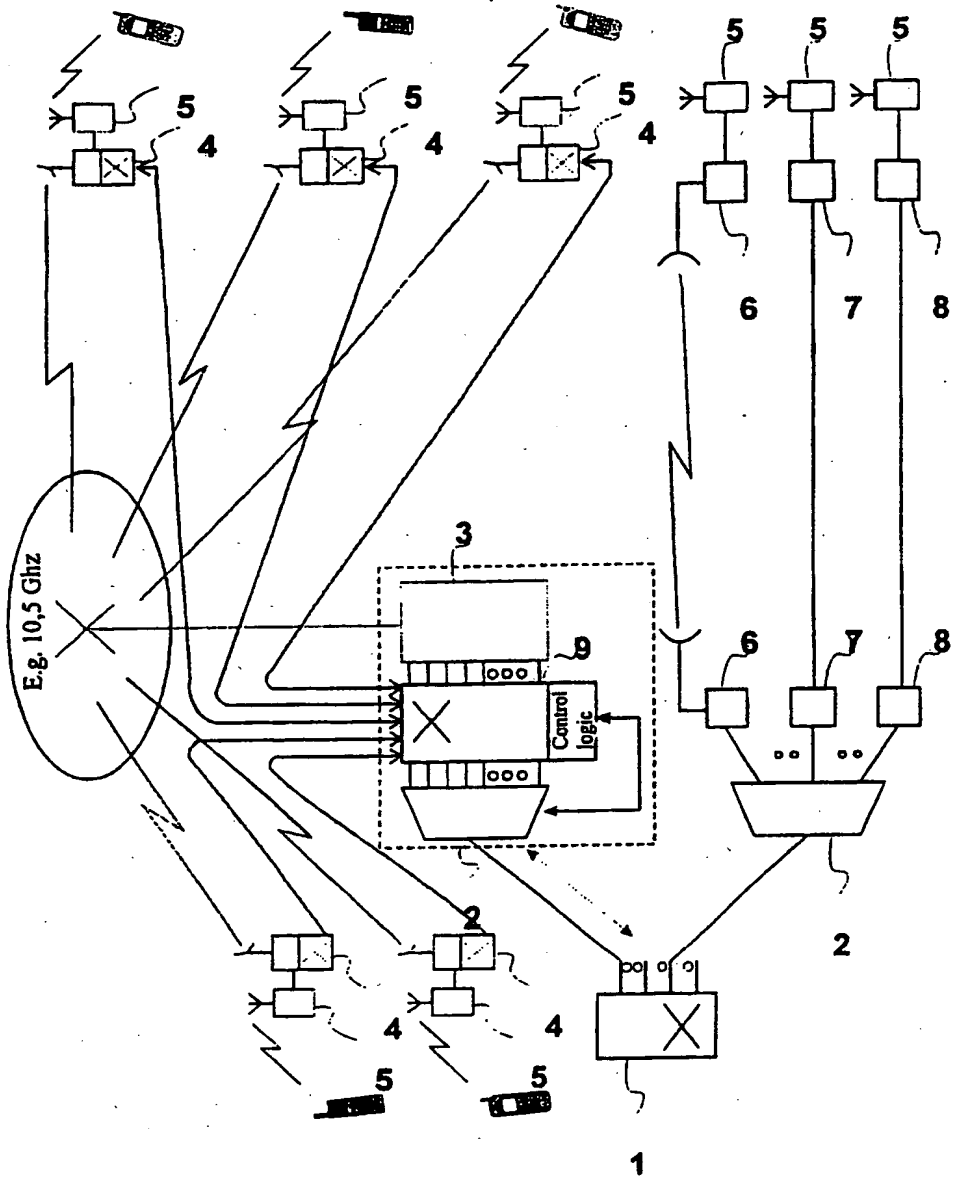


FIG.1.

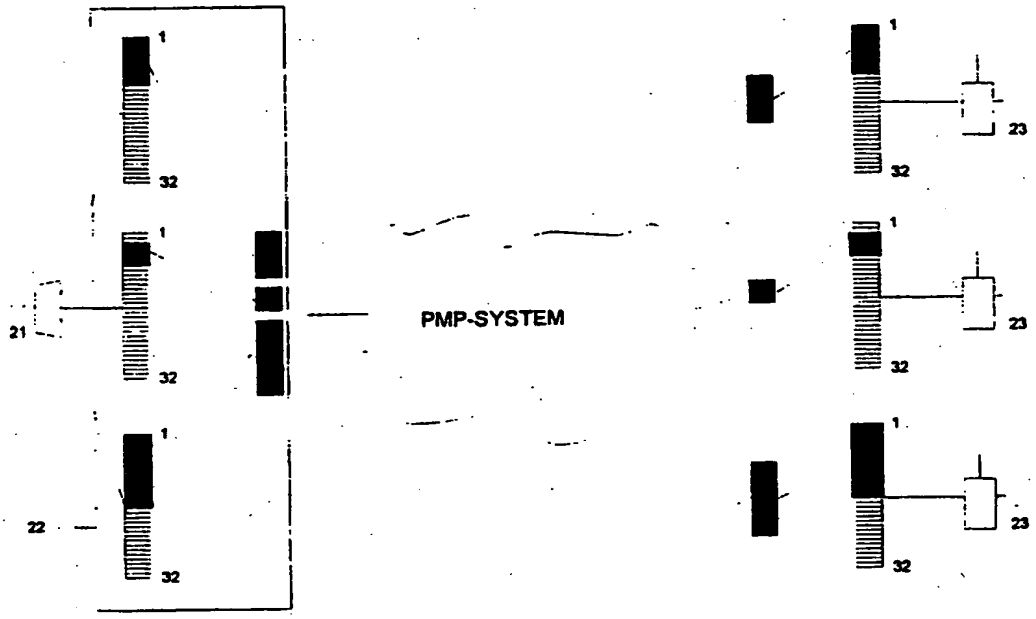

1
32
1
21
32
1
22
32
PMP-SYSTEM
1
23
32
1
23
32
1
23
32

FIG.2.

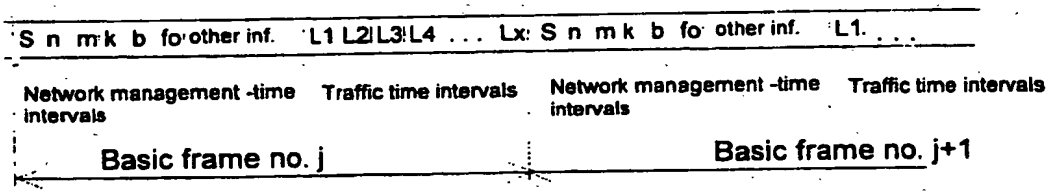

S n m k b fo other inf. L1 L2 L3 L4 . . . Lx: S n m k b fo other inf. L1. . . .
Network management -time intervals
Traffic time intervals
Network management -time intervals
Traffic time intervals
Basic frame no. j
Basic frame no. j+1

FIG.3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00355

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04J 3/16, H04H 1/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04H, H04J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIL, JAPIO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9603841 A1 (GRUNDIG E.M.V. ELECTRO-MECHANISCHE VERSUCHSANSTAL T MAX GRUNDIG GMBH & CO. KG), 8 February 1996 (08.02.96), page 4, line 9 - line 14, abstract --	1-14
P,X	WO 9621293 A1 (FRANCE TELECOM), 11 July 1996 (11.07.96), abstract --	1-14
A	EP 0428407 A2 (DIGITAL EQUIPMENT CORPORATION), 15 November 1990 (15.11.90), abstract -- --------	1-14

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 November 1997	06 -11- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer MIKAEL SOLLERHED Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/10/97

International application No.
PCT/FI 97/00355

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9603841 A1	08/02/96	AU 3115695 A	22/02/96
		DE 4425973 C	20/04/95
		FI 970232 A	20/01/97
		NO 970245 A	20/01/97
WO 9621293 A1	11/07/96	FR 2729030 A,B	05/07/96
EP 0428407 A2	15/11/90	AU 627953 B	03/09/92
		AU 6652490 A	23/05/91
		CA 2029850 A	16/05/91
		JP 3173235 A	26/07/91
		US 5313467 A	17/05/94